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Forest Insect and Disease Management

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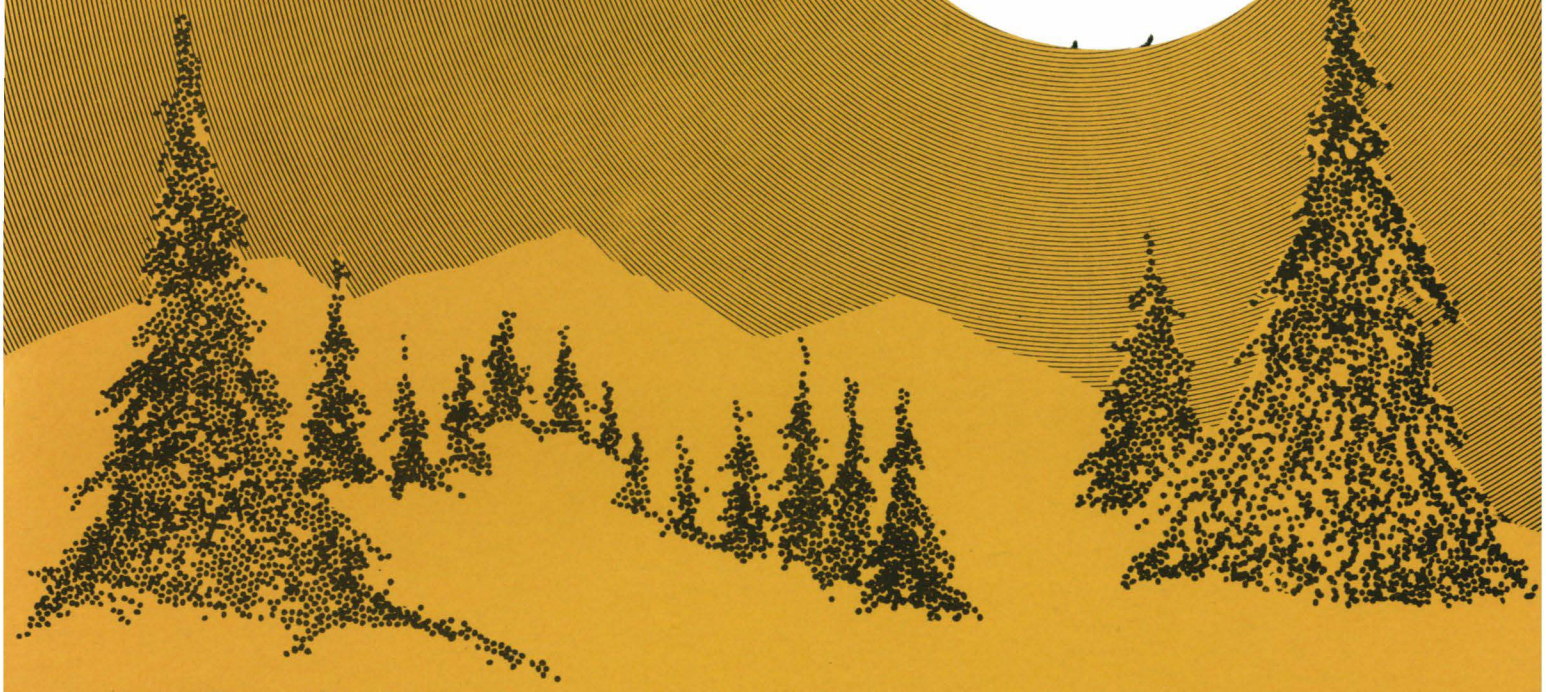
Diplodia Tip Blight of Ponderosa Pine in the Black Hills, South Dakota

July 1979



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Diplodia Tip Blight of Ponderosa Pine in the Black Hills, South Dakota

July 1979

PREPARED BY:

Robert L. James
Plant Pathologist

David W. Johnson
Supervisory Plant Pathologist

William G. Telfer
South Dakota Forest Pest Specialist

APPROVED BY:

G. L. DOWNING
Staff Director
Forest Insect and Disease Management

LARRY D. HENSON
Deputy Regional Forester
State and Private Forestry

Forest Insect and Disease Management
State and Private Forestry
Rocky Mountain Region
USDA Forest Service
11177 W. 8th Avenue
Lakewood, Colorado 80225

ABSTRACT

Diplodia tip blight was found on mature, native ponderosa pine throughout the eastern and southern portions of the Black Hills of South Dakota during July, 1979. Infection was most evident on branches with numerous cones. Fungus fruit bodies were abundant on cone scales and occasionally at the base of necrotic needles on infected branch tips. Although tree mortality was not common, some entire branches had been killed. Affected trees were mostly located within openings and along stand edges. Possible factors associated with the apparent recent appearance of the disease and control measures are discussed.

INTRODUCTION

During the winter of 1978-79 branch tip necrosis of native, mature ponderosa pine (*Pinus ponderosa* Laws.) west of Rapid City, South Dakota was detected by the South Dakota Department of Game, Fish and Parks. Because of the high esthetic value of the trees in this vicinity, damage to trees within residential areas was of special concern. The problem was initially thought to be weather-related due to extremely cold weather before and during symptom development. Initial examination of affected trees failed to reveal the presence of pathogenic organisms or insect activity that would account for the symptoms. Specifically, examination failed to reveal a consistent association with pine twig and branch insects, such as *Petrova, Rhyacionia* and *Dioryctria* species.

During July, 1979 the problem was evaluated by R. L. James and D. W. Johnson, Plant Pathologists, Forest Insect and Disease Management, and W. G. Telfer, South Dakota State Forest Pest Specialist. The purpose of the evaluation was to investigate the etiology, distribution, and importance of the problem.

METHODS

Field examinations of symptomatic trees were conducted along major highways within the eastern portions of the Black Hills. Examinations were concentrated within areas where the problem had been reported by South Dakota District Foresters and homeowners. Symptomatic trees were examined along highways; and cone scales, necrotic twigs, and needles were examined for fungal fruiting bodies. Necrotic and adjacent healthy tissue samples were collected for isolation of pathogenic organisms.

RESULTS

Symptomatology - Progression of diplodia tip blight symptomatology is illustrated in Figs. 1-3. Dieback of current year's foliage was the most characteristic symptom on damaged trees (Figs. 1 & 2). Affected branch tips usually had numerous cones. Severely affected trees had numerous dead branches (Fig. 3). These dead branches were often clustered within the crown rather than located uniformly throughout the crown. Tree mortality was uncommon.

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Symptomatic trees appeared to be more prevalent on the periphery of stands and in open areas. Significant variability in current damage levels was apparent when severely affected trees were adjacent to trees without symptoms.

Black fungal fruiting structures (pycnidia) were common on cone scales (Fig. 4), especially on cones attached to necrotic branches and on the ground under affected trees. Pycnidia were also evident at the base of some necrotic needles beneath fasicle sheaths and along the entire length of ashen-gray needles still attached to affected branches.

Etiology - The primary fungus associated with damage symptoms was *Diplodia pinea* (Desm.) Kickx. Identification was based on (1) characteristic disease symptoms produced, (2) erumpent pycnidia on cone scales and necrotic tissues, and (3) morphology, size, and pigmentation of conidia. Conidia were brown-pigmented, one- or two-celled and measured 10-15 µm in width by 25-35 µm in length. Pathogenicity tests are required to confirm *D. pinea* as the causal agent; however, we feel that the symptoms and signs observed strongly implicate this fungus as the cause of the damage.

Distribution - Sites where the disease was confirmed by close examination of *D. pinea* pycnidia on cone scales and necrotic tissues and isolation of the fungus are shown in Fig. 5. Symptomatic trees were common along the Nemo road northwest of Rapid City. The disease was severe within portions of Westberry Trails Residences, located about 5 miles from Rapid City adjacent to the Nemo Road.

Diseased trees were scattered and less common along Highway 385 south from Nemo. The disease was confirmed at two sites near Hill City (Fig. 5). Symptomatic trees were common along Highway 87 within Wind Cave National Park and Custer State Park. Many groups of diseased trees were noted along Highway 16 (Rushmore Road) southeast of Rapid City. Although the disease was fairly widespread over the surveyed areas, the disease was most common west of Rapid City.

DISCUSSION

This disease has not been previously reported in the Black Hills. Also, symptomatic trees were widespread over a large area. Previous reports have located the disease on mature Austrian pine (*Pinus nigra* Arnold) trees and seedlings within the Bessey Division

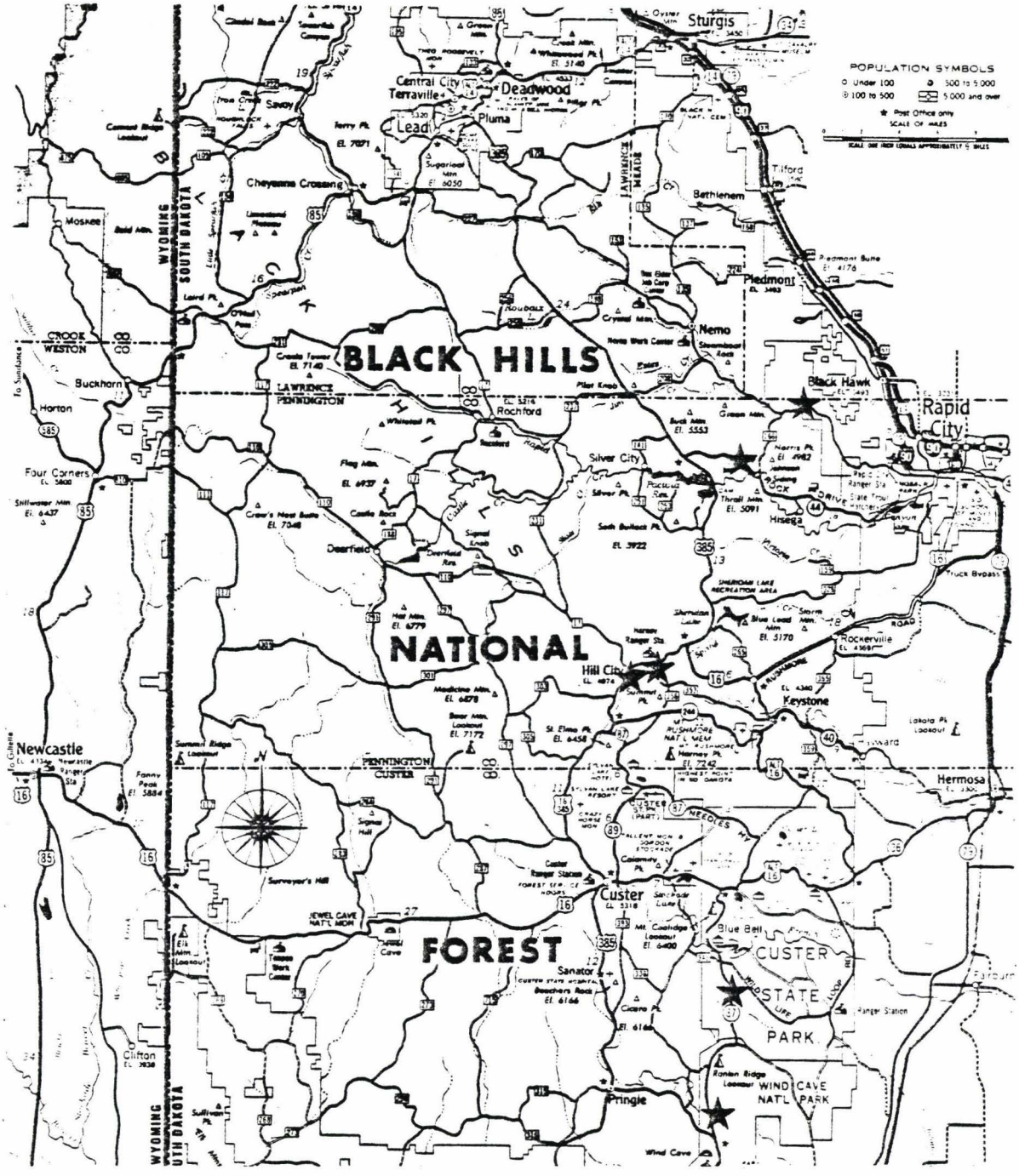

FIGURE 5. Distribution of diplodia tip blight on ponderosa pine within the Black Hills of South Dakota. The fungus was confirmed within those locations indicated with a star (★).

of the Nebraska National Forest (northcentral Nebraska) (6, 12) and on ponderosa pine within Dawes County, Nebraska, south of the Black Hills (W. Ostrofsky, personal communication). Diplodia tip blight is common in portions of eastern South Dakota (11), Nebraska (7, 9, 16), and Kansas (3, 15). The disease was recently reported for the first time on ponderosa pine in southeastern North Dakota (17).

Major hosts of *D. pinea* in the Great Plains include Austrian pine, Scots pine (*Pinus sylvestris* L.) and ponderosa pine. The pathogen has caused most damage to planted Austrian pine over 30 years of age (5, 6, 12). Natural ponderosa pine stands have generally not been damaged much in the past. However, in the Black Hills, the disease was widespread on mature, naturally-regenerated ponderosa pine.

Some investigators have stressed the role of host injury in the development of diplodia tip blight. Bancroft (1) and Purnell (13) reported that only injured shoots and needles were susceptible to infection; however, Waterman (19) reported that wounding favored, but was not required for infection. Brookhouser and Peterson (4) were able to successfully inoculate non-injured pine needles.

Injury induced by abnormal weather conditions may have played a role in the apparent recent development of diplodia tip blight on ponderosa pine in the Black Hills. Drought has been implicated as a predisposing factor to damage by the pathogen (2, 8). Weather records indicate that the 1977 growing season was particularly dry. The Black Hills usually receives most of its annual precipitation during the growing season. Precipitation in 1978 was near normal in the total amount received but was not normally distributed. The summer was wet through the beginning of August resulting in abnormally high relative humidities. From August until May, 1979 (the most recent data), precipitation was below normal. Also, the winters of 1977-1978 and 1978-1979 were extremely cold. Thus the dry summer of 1977 and severe winter of 1977-1978 may have predisposed trees to infection by *D. pinea* by stressing trees and/or providing infection courts by injurying susceptible tissues. The uncommonly humid and rainy early summer of 1978 may have provided ideal conditions for spore dispersal, germination, and needle penetration.

Previous reports (3, 11, 17) indicate that heavy cone infection by *D. pinea* may occur on otherwise healthy pines. We found heavy cone infection usually associated with diseased branches. Possibly cone infection on pines in the Black Hills has been common in the past and branch tip infection only occurred in the presence of predisposing factors such as drought and cold temperatures.

Differences in current damage levels among individual trees is of interest. Although differences in disease susceptibility cannot be ruled out, much of this symptom variability may be due to disease escapes capable of becoming infected later. Because the disease spreads slowly throughout the tree crown over time, incipient infections may not be easily detected. Therefore, many apparently healthy trees may already be infected or become infected in the future.

Diplodia isolated from cone scales and necrotic tissues produced either one-celled or two-celled conidia. One-celled conidia predominated when pycnidia were young, i.e. on tissues incubated for 5-7 days. Two-celled conidia were more abundant in older cultures. Conidia were usually smooth, although occasional granular-margined conidia were found. Two-celled conidia were seldom constricted at septations. The above characteristics, in addition to conidial sizes, correspond to descriptions of *D. pinea* (19).

Effective fungicidal control of diplodia tip blight has been reported (4, 10, 12). Primary infection courts, shoots and new needles, are susceptible from initiation of shoot elongation until needle enlargement (4). Bordeaux mixture applied to foliage as a protectant during late April and early May has provided good control in eastern Nebraska (10, 11). Schweitzer and Sinclair (14) reported good protection from the disease on Austrian pine with the application of benomyl (50% wettable powder) at budbreak and 10 and 25 days later. No chemical is available to eradicate the disease.

Pruning infected branches probably is not effective in reducing inoculum because of the high rate of cone infection. However, pruning may help to improve the appearance of lightly infected trees. Likewise, removal of severely infected trees may improve the overall appearance of infected stands.

We intend to continue monitoring trees for tip blight to determine disease trends. The disease may increase or decrease in severity depending upon environmental conditions. Forest managers and interested homeowners should be alerted to the damage caused by this disease and be kept informed on the progress of the disease in order that effective controls can be used at proper times.

Susceptibility of *D. pinea* as well as western gall rust (*Endocronartium harknessii* (J. P. Moore) Y. Hirat.) is being considered in current ponderosa pine genetic tree improvement work (G. Peterson, personal communication). Perhaps less susceptible pine stock will become available for planting in the future.

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